

TREATMENT OF WATER FOR STEAM BOILERS AND MANUFACTURES.

Water Softening and Treatment. By W. H. Booth. Pp. xvi+308. (London: Archibald Constable and Co., Ltd., 1906.) Price 7s. 6d. net.

THE primary object of this book is the softening of hard water for use in steam boilers and for manufacturing purposes, but, in fact, it deals largely with other matters relating to the supply of water to the boilers of steam engines. Thus it is divided into five sections, the first only of which relates to the treatment of water by softening, together with the separation of oil and filtration, and occupies about half the book; whereas the four other sections, constituting the second half of the book, consist of "Section II., Air Pumps, Condensers, and Circulating Pumps"; "Section III., Feed Heating and Stage Heating"; "Section IV., Water Cooling"; and "Section V., Feed Pumps and Injectors." Accordingly, the volume ranges over the whole subject of the treatment of water supplied to steam boilers, though dealing more expressly with the all-important point of securing, so far as practicable, the purity of the water employed for raising steam.

Comparatively few towns are able to obtain a pure water-supply by storing up the flow of rain off primitive rocks in an uninhabited mountain valley, and conveying it at considerable expense to a distance, as has been accomplished for Liverpool, Manchester, Glasgow, Birmingham, and New York. Waters derived from underground sources, such as springs, rivers fed by springs, or wells, are impregnated more or less with the soluble salts contained in the strata through which they have passed; and when steam is driven off from a boiler fed with such water, these soluble impurities are deposited as scale on the sides of the boiler. This incrustation, being a bad conductor of heat, reduces the efficiency of the boiler, and when very thick may lead to an injurious heating of the metal; whilst the necessary periodical removal of the deposit is tedious and costly, and is liable to damage the inner surface of the boiler. Accordingly, in selecting a site for a factory, the available water-supply should be carefully considered; and where a bored tube well proves the most economical, and an adequate source of supply, the geology of the district should be studied to secure the best site, and ascertain the requisite depth for the well. In such cases some softening process is generally expedient—and often even when water from a river or stream is available—to avoid incrustation of boilers, to prevent a great waste of soap in laundries, and manufactories where washing is resorted to, and to obtain the soft water which is essential in dye works, paper mills, and tanneries.

The author deals successively with the sources and impurities of water, the salts contained in it, the reagents used for softening and their reactions, water-softening apparatus of various kinds, filters, compounds added to the feed-water for preventing or removing scale from boilers, corrosion of boilers, incrustation of pipes, and the chemical and mechanical

removal of oil from condensed steam. The contents of the second half of the book have been sufficiently indicated by the headings of the four sections given above; and the descriptions of apparatus are elucidated by one hundred figures in the text. Altogether, the book contains complete information with respect to the purification and supply of water to steam boilers, which will be valuable to users of steam; whilst the first portion, on water softening, will be very useful in indicating the methods by which hard water may be rendered available for various manufactures requiring pure water.

OUR BOOK SHELF.

Studies in Anatomy from the Anatomical Department of the University of Manchester. Vol. iii. Edited by Prof. Alfred H. Young. Pp. 289; 23 plates. (Manchester: University Press, 1906.) Price 10s. net.

IN the struggle to build and equip laboratories for research, the provision of means to secure the full publication of the fruits of discovery has been too often left out of sight. If the best work is to be obtained from those who devote themselves to investigation, and progress made by collective effort, the means of publication become almost as important as those of investigation. The University of Manchester has recognised this fact. The present collection of studies in anatomy—the third issued since Prof. Young occupied the chair in the Owens College—appears as the first volume of the anatomical series of the publications now being issued by the University of Manchester. In this volume there are ten papers by men who work or have worked in the anatomical department under Prof. Young.

A number of the papers in this volume, such as those by Profs. Robinson and Thompson, are reprinted from the *Journal of Anatomy and Physiology*, but all of them, old and new alike, are real additions to the knowledge of the subject with which they deal. Dr. J. Cameron's observations on the development of the optic nerves in amphibians deal with a subject which has been keenly discussed during the last thirty years, viz. the manner in which nerve fibres are developed. From a study of the appearances presented by the developing fibres in the optic nerve of amphibians, Dr. Cameron concludes that the fibres begin as outgrowths from the ganglion cells of the retina, but that their further growth towards the brain is obtained by the cooperation of the cells of the optic stalk, the growing point of the nerve fibre being formed from substance derived from the optic stalk cells.

The longest paper in the collection is Dr. C. W. S. Saberton's study of the nerve plexuses of four chimpanzees, an accurate and very useful contribution to the data which must be collected before we can finally settle the problem of man's origin. Everyone who has worked at this problem is fully aware that it cannot be settled by the examination of single specimens of each species, but by dissection of large numbers; the difficulty in obtaining anthropoids, the degree of individual variation, the great labour entailed by dissection, and the expense entailed by publication, have kept us from reaching a definite conception of the exact relationship of man and the higher primates to one another. Hence Dr. Saberton's contribution to available data is very welcome. In his paper on the development and morphology of the sternum, Dr. Lickley has reverted to the older

conception of that bone, viz. that it is of costal origin, but the evidence on which he bases his conclusions is not convincing. For three of the studies Prof. Young is either in part or wholly responsible, and he is to be congratulated on the vigour shown by the Manchester school of anatomists.

Refraktionstafeln. By Dr. L. de Ball, Direktor der v. Kuffnerschen Sternwarte. Pp. xiv+18. (Leipzig: W. Engelmann, 1906.) Price 2.40 marks.

THE methods of computing corrections for atmospheric refraction have always been more or less unsatisfactory. The conditions of the problem do not lend themselves to extreme accuracy on account of the uncertainty of the meteorological elements introduced. The determination of the density of the atmosphere at any precise moment, dependent as it is on the temperature, the amount of aqueous vapour present, and other conditions, is not simple, and custom and authority alike have sanctioned the employment of rough and approximate data. Bessel's tables, so long in use, were admittedly founded upon inadequate material, and probably would have long since been superseded but for the inconvenience that arises when any breach of continuity occurs in a long series of observations; but in observatories where measures of zenith distance have been made at small altitudes this inconvenience has had to be faced. At Greenwich, for example, corrections to Bessel's tables, or Airy's modifications of them, have been alternately introduced and rejected in the treatment of observations at large zenith distances.

In the tables which Dr. L. de Ball has issued the difficulty of continuing an unbroken series of corrections, available from the zenith to the horizon, has not been attempted. The tables as arranged are available up to 75° zenith distance, and within this limit represent a consistent theory, that of M. Radau. The form in which the tables are constructed gives the log. of the refraction presumably correct to four places of decimals. In the example worked out it has been necessary to take out five significant integers, and, if the second decimal place is to be correct, this may be rather a severe strain on four-figure logs.; but Dr. L. de Ball gives very good and sufficient reasons for not extending the tables beyond these limits. He reminds us that the determination of the temperature of the air is not so easy as the reading of a thermometer seems to suggest. The thermometer bulb is affected by the heat rays emitted by the objects which surround it, whilst the air absorbs only a part of those rays. On these grounds the temperature indicated by the thermometer may easily differ 0.2°C . from that of the atmosphere, and such a difference would occasion an error of three units in the fourth decimal of the log. of the density, and a similar amount in the log. of the refraction. The tables aim at giving an accuracy which is sufficient and practical rather than making a claim to extreme and misleading rigour. A further proof that the author has considered the practical side is shown by the fact that he has included tables designed to assist the computation of differences of refraction, applicable to the reduction of heliometer and photographic observations.

The Butterflies of the British Isles. By Richard South, F.E.S. Pp. x+204. (London: Frederick Warne and Co., 1906.) Price 6s. net.

NOTWITHSTANDING the large number of books relating to British butterflies, there was still room for a pocket handbook which should do for the present generation what Coleman's "British Butterflies" did for the last, and this want Mr. South has set himself to provide. He has succeeded in giving us a portable little book, well up to date, containing full

information about structure, transformation, setting, &c., besides a good account of the individual species. The plates contain coloured figures of the butterflies on one side of the page, and plain figures of caterpillars, &c., on the back, thus doubling the number of page illustrations without adding to the thickness of the book. The illustrations in the text are nearly all in the introduction. They are uncoloured, and some of them are taken from Sharp, Aurivillius, and other trustworthy authorities.

Mr. South admits sixty-eight species as British, but regards only fifty-seven of these as actual natives; but surely, though some of the remainder are extinct, and others only casual visitors, the black-veined white (once abundant, but now almost extinct in England); and the red admiral, still one of the commonest of the *Vanessidæ*, ought to have been included among the genuine natives. The evidence against the red admiral being a genuine British species seems to rest on the assumption of its being a migrant, though this is admittedly not proved, as it is abundantly in the case of its nearest ally, the painted lady.

The rapid disappearance of butterflies in England is doubtless largely due to the wholesale clearing away of the weeds and plants on which the caterpillars feed, by the utilisation of every scrap of waste ground. Yet this cannot be the only reason, or the black-veined white, which feeds on hawthorn as well as on fruit trees, would not be disappearing. In this case the disappearance of the butterfly seems to be due to the increase of insect-eating birds. Every fresh book on butterflies records the increasing scarcity of many species once common, and there are only a few, such as the clover-feeding clouded yellows, which are more plentiful now than in former days.

In the case of the smaller and more variable butterflies, a considerable number of varieties are figured (sometimes as many as seventeen on one plate), and we think that most entomologists who are interested in British butterflies will find Mr. South's little book a very useful supplement to any they may already happen to possess on the same subject.

W. F. K.

LETTER TO THE EDITOR.

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The Latest Critic of Biometry.

MR. J. J. LISTER in his presidential address to Section D at the British Association felt it his duty to go somewhat out of his way in order to urge on biometricians "that the old adage should be borne in mind recommending that before beginning culinary operations it is advisable first to catch your hare, in other words, to make sure that the problem you seek to elucidate is sound from the standpoint of biology before bringing a formidable mathematical apparatus into action for its investigation" (*NATURE*, August 16, p. 400). The importance of the occasion no doubt prevented Mr. Lister from illustrating his criticism; he had much else to deal with, and he probably hoped that his words without detailed proof would have all the weight which attaches to presidential utterances. These are not made without careful thought and proper study. But in order that a criticism of this kind should be effective, biometricians need more information, and they recognised that Mr. Lister could hardly refuse to cite instances of the type of work which led to his advice.

Hoping that we might profit by Mr. Lister's caution, I wrote to him as soon as I read his paper in your columns asking for definite instances upon which we might consider how to amend our courses. He has kindly consented to